PUA (polyunsaturated aldehydes) experiments: Chlorophyll-a concentrations, Virginia Coastal Bays and Bay of Napoli, Mar-July 2015

Website: https://www.bco-dmo.org/dataset/774017
Data Type: experimental
Version: 1
Version Date: 2019-07-31

Project

» The effects of diatom-produced polyunsaturated aldehydes on the microbial food web in temperate and polar waters (DiatomAldehydes)

Contributors	Affiliation	Role
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Abstract

PUA (polyunsaturated aldehydes) experiments: Chlorophyll-a concentrations, Virginia Coastal Bays and Bay of Napoli, Mar-July 2015.

Table of Contents

- Funding

Coverage

Spatial Extent: **N**:40.808 **E**:14.25 **S**:37.1656 **W**:-75.9866
Temporal Extent: 2015-03-23 - 2015-07-02

Dataset Description

This dataset reports the chlorophyll-a concentrations for polyunsaturated aldehydes (PUA) experiments with samples from Virginia Coastal Bays and Bay of Napoli.

Acquisition Description

Experiments were conducted by collecting raw seawater, filtering it through 200µm mesh sieves into 20L carboys, and then dispensing it into experimental jars. Triplicates bottles were used for each treatment. Treatments included whole seawater (control), whole seawater plus copepods (Zooplankton), and the same treatments plus PUA additions (Heptadienal, Octadienal, Decadienal, and Mixed PUA). PUA were dissolved in methanol and added to experimental bottles for a final concentration of 21 nM; for the mixed PUA treatment this was 7nM of each type of PUA.

Initial samples were collected from the carboy for chlorophyll a as described below. Final samples were collected from each treatment and control bottle as described below.

Chlorophyll a samples (50-150ml) were filtered onto 25mm diameter GF/F filters (nominal 0.7 micrometer pore size), and filters were extracted in 90% acetone at -20 degrees C for 24 hours using the acid method (EPA Method 445 - Arar & Collins 1997), then analyzed on a Turner Designs AU10 or TD700 fluorometer.

All data were processed in Microsoft Excel.

Processing Description

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- reduced some Chl_a values to 6 decimal places

[table of contents | back to top]

Related Publications

Franzè, G., Pierson, J. J., Stoecker, D. K., & Lavrentyev, P. J. (2017). Diatom-produced allelochemicals trigger trophic cascades in the planktonic food web. Limnology and Oceanography, 63(3), 1093–1108. doi:10.1002/lno.10756

Lavrentyev, P., Franzè, G., Pierson, J., & Stoecker, D. (2015). The Effect of Dissolved Polyunsaturated Aldehydes on Microzooplankton Growth Rates in the Chesapeake Bay and Atlantic Coastal Waters. Marine Drugs, 13(5), 2834–2856. doi:10.3390/md13052834

[table of contents | back to top]

Parameters

Parameter	Description	Units
Experiment	Name of the Experiment	unitless
Treatment	Treatment name	unitless
Rep	Replicate number	unitless
Chl	Chlorophyll a concentration determined from acetone extraction	micrograms/liter

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Turner Designs AU10 fluorometer
Generic Instrument Name	Turner Designs Fluorometer -10-AU
Dataset-specific Description	Chlorophyll a concentrations were determined on a Turner Designs AU10 fluorometer after extraction in 90% acetone at 0°C. The fluorometer was calibrated using a 5 point calibration with a chlorophyll a standard
Generic Instrument Description	The Turner Designs 10-AU Field Fluorometer is used to measure Chlorophyll fluorescence. The 10AU Fluorometer can be set up for continuous-flow monitoring or discrete sample analyses. A variety of compounds can be measured using application-specific optical filters available from the manufacturer. (read more from Turner Designs, turnerdesigns.com, Sunnyvale, CA, USA)

[table of contents | back to top]

Project Information

The effects of diatom-produced polyunsaturated aldehydes on the microbial food web in temperate and polar waters (DiatomAldehydes)

Description from NSF award abstract: This project will conduct a set of field/laboratory experiments to address the following hypotheses with respect to microzooplankton (consumers between 20-200 um) and diatom- produced polyunsaturated aldehydes: I. Aldehydes will impair microzooplankton herbivory on diatoms and non-diatom phytoplankton. II. Aldehydes will reduce the growth rates of microzooplankton and non PUA-producing phytoplankton. III. In the presence of aldehyde-producing diatoms, copepods will switch to microzooplankton, whereas non- (mildly)- toxic diatoms will be an important food source for copepods. IV. The effects of aldehydes on microzooplankton and copepods will depend on the grazers' prior exposure to PUA. The experiments will include natural plankton, captured copepods, cultured Skeletonema marinoi (SM), including its aldehyde-producing strain, and synthetic aldehydes. To gain insights into complex interactions within planktonic communities, detailed information on their composition, abundance, and dynamics will be obtained using microscopy, flow-cytometry, and cytological methods. This approach will allow the PIs to draw conclusions about

the role of diatom-produced aldehydes in phytoplankton-microzooplankton- copepod trophic interactions. The PIs will coordinate efforts and exchange information with the PUA study group at the Stazione Zoologica Anton Dohrn (Naples, Italy). Diatoms are dominant autotrophic plankton in the ocean. Recent evidence indicates that microzooplankton are the dominant herbivores, whereas copepods often rely on microzooplankton as food, except during peak diatom production. The ability of microzooplankton to feed on large diatoms and grow as fast as their algal prey leads to the question of what allows diatoms to escape microzooplankton grazing control during the initial phases of their blooms and maintain the blooms until nutrient resources are depleted? Allelopathy is wide spread among phytoplankton. The cosmopolitan bloom-forming SM produces several aldehydes and has become a model organism in plankton allelopathy studies. Most studies on diatom cytotoxicity have been dedicated to inhibitory effects on reproduction and development of marine invertebrates, whereas surprisingly little information exists on its impact on key diatom grazers, microzooplankton. Preliminary results in the Chesapeake Bay show that aldehydes may induce cascading effects within planktonic communities. The proposed study will: (1) Improve our knowledge of the critical diatom-microzooplankton-copepod links in the coastal ocean; (2) Generate novel data on the effects of allelopathy on marine food webs; (3) Contribute to our understanding of broader patterns of marine ecosystems by comparing plankton structure and dynamics in the temperate Atlantic waters; (4) Advance biological oceanography through international collaboration.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1357168
NSF Division of Ocean Sciences (NSF OCE)	OCE-1357169

[table of contents | back to top]